

1 HANDS-FREE KIT FOR MOBILE PHONE

2

3 The present invention relates to a hands-free kit for use with  
4 a mobile phone.

5

6 BACKGROUND OF THE INVENTION

7

8 Hands-free kits, each including an earphone and a microphone,  
9 are becoming popular for use with portable mobile phones, as  
10 they free the hands of a user who can then attend to other  
11 things as desired or with care, such as driving a vehicle.  
12 Experiments or statistics suggest that the electromagnetic  
13 radiation emitted by a mobile phone may be harmful to the  
14 brain. Although a hands-free kit is useful to keep the mobile  
15 phone physically away from the head, electrically conductive  
16 parts of the kit, including in particular the earphone that is  
17 in use located in the ear, also transmit and emit  
18 electromagnetic radiation.

19

20 The invention seeks to mitigate or to at least alleviate such a  
21 problem by providing a hands-free kit for a mobile phone.

22

23 SUMMARY OF THE INVENTION

24

25 According to a first aspect of the invention, there is provided  
26 a hands-free kit for a mobile phone having a hands-free  
27 connection port, comprising a speaker, a microphone, a  
28 connector for connection with a said port, an electrical cable

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1 connecting the speaker and the microphone to the connector, and  
2 a tube having a first end connectable with the speaker and a  
3 second end comprising an earplug. The tube is adapted to act as  
4 an acoustic passage to transmit sound reproduced by the speaker  
5 to the earplug.

6

7 Preferably, the tube is flexible, and may be made of non-  
8 metallic material, such as rubber or plastic material.

9

10 It is preferred that the speaker has a body, and the first end  
11 of the tube receives to enclose and thus connect with the  
12 speaker body.

13

14 It is further preferred that the tube is enlarged at its first  
15 end to connect with the speaker body, and includes a section  
16 immediately adjacent the enlarged end that is tapered to  
17 concentrate sound emitted by the speaker into the tube.

18

19 According to a second aspect of the invention, there is  
20 provided an acoustic passage for use with a mobile phone hands-  
21 free earphone comprising a speaker and a microphone, which  
22 passage comprises a tube having a first end comprising means  
23 for connecting with a said speaker and a second end comprising  
24 an earplug. The tube is adapted to transmit sound reproduced by  
25 the speaker to the earplug.

26

27 Preferably, the tube is flexible, and may be made of non-  
28 metallic material, such as rubber or plastic material.

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1

2 It is preferred that the first end of the tube is adapted to  
3 receive and thus connect with a said speaker.

4

5 It is further preferred that the first end of the tube is  
6 enlarged for connecting with a said speaker, and the tube  
7 includes a section immediately adjacent the enlarged end that  
8 is tapered to concentrate sound emitted by a said speaker into  
9 the tube.

10

11 In a preferred embodiment, said means comprises an enclosure  
12 which provides a cavity adapted to house and locate wholly  
13 therein a said speaker and includes an opening to which the  
14 first end of the tube is connected for communicating with the  
15 cavity.

16

17 Preferably, the cavity has an entire inner surface and is  
18 provided with a metal shield that covers a substantial part of  
19 the entire inner surface to surround a said speaker.

20

21 More preferably, the shield is formed by two substantially  
22 identical shells closing with each other.

23

24 It is preferred that the shield has a shape matching with that  
25 of the inner surface of the cavity and is in ultimate surface  
26 contact therewith.

27

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1 Preferably, the enclosure provides a first cavity that is the  
2 first mentioned cavity and also a second cavity that provides a  
3 sound passage which has a first end connected to the first  
4 cavity for communicating therewith and a second end that acts  
5 as the opening to which the first end of the tube is connected.

6  
7 More preferably, the sound passage extends in a substantially  
8 spiral manner having an outer end as the said first end and an  
9 inner end as the said second end.

10  
11 Further more preferably, the sound passage has at least half a  
12 turn and up to two turns.

13  
14 Preferably, the enclosure provides another cavity adapted to  
15 house and locate wholly therein a said microphone.

16  
17 More preferably, said another cavity has an entire inner  
18 surface and is provided with a metal shield that covers  
19 substantially the entire inner surface to surround a said  
20 microphone.

21  
22 Further, the shield is preferably formed by two substantially  
23 identical shells closing with each other.

24  
25 It is preferred that the shield has a shape matching with that  
26 of the inner surface of the cavity and is in ultimate surface  
27 contact therewith.

28

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1 In a specific construction, the enclosure is to be formed by  
2 two connected parts having respective walls abutting each  
3 other, which walls are shaped and combine to form at their  
4 interface the cavity or cavities.

5

6 More specifically, the or each cavity is formed by two  
7 substantially identical parts, one from the wall of each part  
8 of the enclosure.

9

10 Conveniently, the enclosure has an open outer side and a hollow  
11 interior accessible through the open side for storing at least  
12 part of the tube and the earplug.

13

14 Conveniently, the enclosure is provided with a fastener for  
15 fastening the overall acoustic passage onto the body of a user.

16

17 In a specific construction, the earplug comprises a tubular  
18 plug for insertion into the hole of a user's ear and an  
19 integral outer member extending around the plug for holding  
20 onto the inner surface of a said user's ear by friction.

21

22 The acoustic passage may be combined with a mobile phone  
23 hands-free earphone comprising a speaker and a microphone, in  
24 which the speaker is housed within the or the first cavity.

25

26 The acoustic passage may be combined with a mobile phone  
27 hands-free earphone comprising a speaker and a microphone, in

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1 which the speaker is housed within the or the first cavity  
2 and the microphone is housed within said another cavity.  
3

4 BRIEF DESCRIPTION OF DRAWINGS

5

6 The invention will now be more particularly described, by way  
7 of example only, with reference to the accompanying drawings,  
8 in which:  
9

10 Figure 1 is a cross-sectional view of a first embodiment of a  
11 hands-free kit in accordance with the invention, showing its  
12 use with a mobile phone;  
13

14 Figure 2 is a side view of a conventional hands-free earphone;  
15

16 Figure 3 is a cross-sectional side view of a second embodiment  
17 of a hands-free kit in accordance with the invention, said kit  
18 incorporating the hands-free earphone of Figure 2;  
19

20 Figure 4 is a top plan view of the hands-free kit of Figure 3;  
21

22 Figure 5 is a bottom plan view of the hands-free kit of Figure  
23 3;  
24

25 Figure 6 is a top plan view of the hands-free kit of Figure 3,  
26 showing the kit in a packed condition;  
27

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1 Figure 7 is a cross-sectional end view of the packed hands-free  
2 kit of Figure 6;

3

4 Figure 8 is a bottom plan view of a slightly different  
5 embodiment of the hands-free kit of Figure 3; and

6

7 Figure 9 is a side view of a modified earplug for the hands-  
8 free kit of Figure 3 or Figure 8.

9

10 DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

11  
12 Referring initially to Figure 1 of the drawings, there is shown  
13 a first hands-free kit 100 embodying the invention for use with  
14 a portable mobile phone 10, which kit 100 comprises a macro  
15 speaker 110, a microphone 120 and a flexible rubber tube 130.

16 The speaker 110 is connected to the microphone 120 by means of  
17 a multi-cored cable 140 that extends beyond the microphone 120.  
18 The cable 140 terminates at an end fitted with a signal plug  
19 150 designed for insertion into a hands-free connection port  
20 provided at the bottom end of the mobile phone 10.

21  
22 The speaker 110 has a body 112 and includes a sound reproducing  
23 mechanism, such as a diaphragm driven by a moving coil and  
24 electromagnet, for reproducing sound from an electrical signal  
25 supplied by the mobile phone 10 via the cable 140. The  
26 microphone 120 has an oval-shaped body 122 which is connected  
27 at an intermediate position along the cable 140 and includes a  
28 press knob 124 for accepting or terminating a telephone call.

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1  
2 The tube 130 has a front end provided with an earplug 132 and a  
3 rear end that is suitably enlarged to form a receptacle 134,  
4 for example, for receiving to enclose and thus connect with the  
5 speaker 110. The main body of the tube 130 acts as an acoustic  
6 passage for transmitting or delivering sound from the speaker  
7 110 to the earplug 132, and is made generally as thin as  
8 possible for flexibility and lightweight.

9  
10 The earplug 132 has a front opening and is preferably  
11 integrally formed at the front end of the tube 130, or  
12 otherwise formed as a separate part connected thereto. The  
13 earplug 132 is shaped and sized to anchor within the user's  
14 ear.

15  
16 The receptacle 134 has a shape corresponding to that of the  
17 body 112 of the speaker 110 and is preferably slightly  
18 stretchable for enclosing the speaker body 112 to connect tight  
19 therewith. The section of the tube 130 immediately adjacent the  
20 receptacle 134 is preferably made to taper in a conical manner,  
21 gradually reducing in diameter from the receptacle 134, for  
22 concentrating and directing the sound emitted by the speaker  
23 110 into the tube 130.

24  
25 The rubber tube 130 serves to separate the speaker 110 apart  
26 from the user's ear as far as possible for a distance that is  
27 in effect the length of the tube 130, thereby isolating or at  
28 least substantially minimising the effect of the

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1 electromagnetic radiation of the mobile phone 10 as transmitted  
2 or emitted by the speaker 110. The tube 130 acts as a voice  
3 collector bridging from the speaker 110 to the user's ear, said  
4 connector containing no metallic or electrically conductive  
5 material to transmit electromagnetic radiation.

6

7 In general, the tube 130 is made of non-metallic material.  
8 Specifically, the tube 130 is preferably made of rubber,  
9 silicone rubber or other suitable plastic material. It is known  
10 that certain material can suppress or absorb electromagnetic  
11 radiation, and such material is also suitable for producing the  
12 tube 130, as either the base material or an additive.

13

14 In the described hands-free kit 100, the tube 130 is about 20cm  
15 long, and the microphone 120 is connected on the cable 140. In  
16 a different construction, it is envisaged that the microphone  
17 120 may be mounted on the tube 130 instead, at around the rear  
18 end of the tube 130, such that the microphone 120 is positioned  
19 closer to the user's mouth.

20

21 Apart from the tube 130, the other parts of the hands-free kit  
22 100 may be standard components of a conventional hands-free  
23 earphone, with the speaker 110 being in the form of a typical  
24 earphone. It is therefore intended that the tube 130 may be  
25 supplied alone as an accessory for use with an existing hands-  
26 free earphone, in which case the rear end of the tube 130  
27 should be fabricated for (releasable) connection to the  
28 earphone.

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1  
2 Reference is now made to Figures 2 to 7 of the drawings, which  
3 show a second hands-free kit 200 embodying the invention for  
4 use with a portable mobile phone. The kit 200 incorporates a  
5 conventional hands-free earphone 12 that comprises a macro  
6 speaker 13 and a microphone 14 and includes a signal plug 15 to  
7 which both the speaker 13 and the microphone 14 are connected  
8 by means of a multi-cored cable 16. The plug 15 is designed for  
9 insertion into a hands-free connection port of a mobile phone.  
10  
11 The hands-free kit 200 includes an enclosure in the form of a  
12 rectangular (or round) plastic box 210 having opposite first  
13 and second ends 212 and 214, which is formed by top and bottom  
14 parts 220 and 230 that have matching rectangular (or round)  
15 shapes and are stacked and secured together by ultrasonic  
16 welding. The top and bottom box parts 220 and 230 have  
17 respective lower and upper walls 222 and 232 abutting each  
18 other, which are both moulded to form in their interfacing  
19 surfaces a series of three enclosed cavities 240, 250 and 260  
20 along the longitudinal extent of the box 210. An external  
21 fastener in the form of a spring-loaded clip 216 is provided at  
22 the second end 214 of the box 210.  
23  
24 Each cavity 240/250/260 is created by a corresponding pair of  
25 aligned recesses closing with each other, which have  
26 substantially identical shapes as mirror images compared with  
27 each other and are formed in the confronting walls 222 and 232  
28 of the two box parts 220 and 230 respectively. The first and

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1 second cavities 240 and 250 are in communication with each  
2 other.

3

4 The first cavity 240 is generally pear-shaped having a  
5 conically tapered open front end 242 and houses wholly therein  
6 the speaker 13 of the hands-free earphone 12. A metal (copper,  
7 aluminium or iron) shield 244 of a matching shape is located  
8 within the cavity 240 to cover, in ultimate surface contact  
9 with, a substantial part of the entire inner surface of the  
10 cavity 240. The shield 244 surrounds the speaker 13 and is  
11 intended to confine the electromagnetic radiation of the  
12 speaker 13 within the cavity 240 and thus avoid or minimise its  
13 leakage out of the cavity 240. The shield 244 is formed by a  
14 pair of identical upper and lower shells 246 closing with each  
15 other, together having a conically tapered open front end 248  
16 aligned with the open end 242 of the cavity 240.

17

18 The speaker 13 is preferably surrounded tight by a ring 249 of  
19 a soft material such as rubber and is then clamped between the  
20 two shells 246 of the shield 244. The ring 249 serves to ensure  
21 that the speaker 13 is fixed and is better acoustically  
22 shielded. The speaker 13 is located to be directly facing and  
23 pointing at the aligned open ends 248 and 242 of the shield 240  
24 and cavity 240, such that the sound reproduced by the speaker  
25 13 is concentrated and guided by the conically tapered open  
26 ends 248 and 242 into the second cavity 250.

27

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A passage 241 is formed at the interface between the confronting walls 222 and 232 of the two box parts 220 and 230, which extends from rear ends of the first cavity 240 and shield 244 to the outside at the first end 212 of the box 210. The passage 241 accommodates and allows the section of the cable 16 of the hands-free earphone 12 connecting between the speaker 13 and the signal plug 15 to extend out of the box 210, such that the signal plug 15 stays outside the box 210.

The second cavity 250 extends in a spiral manner or shape of at least half a turn and up to two turns, having outer and inner open ends 252 and 254. The outer end 252 is integrally formed with the open end 242 of the first cavity 240. The first cavity 240 is oriented at an acute angle of about  $45^{\circ}$  relative to the second cavity 250 such that their open ends 242 and 248 are co-axially aligned with each other. This arrangement ensures that the sound of the speaker 13 from the first cavity 240 can enter straight, without turning, into the second cavity 250, whereby loss of sound is minimised.

The second cavity 250 provides a smoothly curved, spiral sound passage for delivering the sound received from the first cavity 240. The inner end 254 of the second cavity 250 turns through an angle of  $90^{\circ}$  to point downwards off the plane of the spiral shape.

The third cavity 260 has an oblong shape that extends laterally across the box 210 and corresponds to that of the microphone 14

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1 of the hands-free earphone 12 for housing the entire microphone  
2 14. A metal (copper or aluminium) shield 264 of a matching  
3 shape is located within the cavity 260 to cover, in ultimate  
4 surface contact with, substantially the entire inner surface of  
5 the cavity 260. The shield 264 is formed by a pair of identical  
6 upper and lower shells 266 closing with each other to surround  
7 the microphone 14, and serves to confine electromagnetic  
8 radiation of the microphone 14 within the cavity 260 and thus  
9 avoid or minimise its leakage out of the cavity 260.

10  
11 Although this is not shown in the drawings, another passage is  
12 formed at the interface between the confronting walls 222 and  
13 232 of the two box parts 220 and 230, which extends between the  
14 first and the third cavities 240 and 260 and accommodates the  
15 section of the cable 16 connecting between the speaker 13 and  
16 microphone 14.

17  
18 The hands-free kit 200 further includes a flexible acoustic  
19 tube 270/280 that is formed by a relatively long rubber tube  
20 270 and a relative short soft plastic pipe 280 connected  
21 lengthwise together. The rubber tube 270 has a crooked first  
22 end 272 placed inside the lower part 230 of the box 210, which  
23 is stretched over to connect with the inner end 254 of the  
24 second cavity 250, for communicating with the cavity 250. An  
25 integral hook or bracket 268 extends from below the third  
26 cavity 260 and holds the tube 270 in place. The tube 270  
27 extends out from the second end 214 of the box 210 and then

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1 terminates as a straight second end 274 formed with an annular  
2 integral flange 276.

3

4 The pipe 280 is crooked, having a first end 282 coupled  
5 straight with the second end 274 of the rubber tube 270 by  
6 means of a rigid locking collar 278, and including a second end  
7 in the form of an earplug 284. The collar 278 is slid on and  
8 locks the pipe end 282 tightly around the tube end 274 at a  
9 position stopped by the flange 276.

10

11 The earplug 284 has a central tubular plug 286 and a generally  
12 flat cylindrical outer flange 288 extending concentrically  
13 around the plug 286. The flange 288 is spaced apart from the  
14 plug 286 and is integrally connected to the rear end of the  
15 plug 286 by a circular disc-like web 287. The flange 288 and  
16 the web 287 together resemble a cap, with the plug 286  
17 protruding slightly out of the cap or beyond the flange 288.  
18 When the earplug 284 is inserted into the ear of a user, the  
19 plug 286 extends into the hole of the ear for sound delivery,  
20 while the flange 288 holds onto the inner surface of the ear by  
21 friction and thus locates the overall earplug 284 in place.

22

23 The top part 220 of the box 210 is hollow around the regions  
24 forming the upper halves of the cavities 240 to 260, and its  
25 outer (upper) side 217 is open into which the hollow interior  
26 is accessible. The interior is useful to store the acoustic  
27 tube 270/280 over the majority of its exposed length and the  
28 signal plug 15 with cable 16 running therefrom, when the hands-

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1 free kit 200 is not in use. Appropriate top cut-outs may be  
2 formed in the side walls of the box part 220 to facilitate  
3 entrance of the acoustic tube 270/280 and the signal plug cable  
4 16 into the storage space. The open side 217 is to be closed by  
5 a flap 218 extending from a longer side of the box 210 to the  
6 opposite side where suitable Velcro (trade mark) connectors 219  
7 are provided.

8  
9 The box 210 measures approximately 8.5cm by 5.6cm, and the  
10 exposed length of the acoustic tube 270/280 is preferably in  
11 the range from 16.5cm to 28cm.

12  
13 In use, the hands-free kit 200 is hanged on the chest of a user  
14 by means of the clip 216, with the signal plug 15 connected to  
15 a mobile phone and the earplug 284 inserted into either the  
16 left or the right ear of the user. The acoustic tube 270/280,  
17 which is joined to the second cavity 250, acts as an acoustic  
18 passage for delivering the sound of the speaker 13 received  
19 from the first cavity 240 via the second cavity 250. The sound  
20 travels on to reach the user's ear via the earplug 284.

21  
22 The acoustic tube 270/280 serves to separate the speaker 13  
23 physically apart from the user's ear, and hence the brain, for  
24 a distance that is believed to be sufficiently long to isolate  
25 or at least substantially minimise the undesirable effect of  
26 the electromagnetic radiation of a mobile phone in use as  
27 transmitted or emitted by the speaker 13. The tube 270/280 does  
28 not contain any metallic or electrically conductive material

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1 that transmits electromagnetic radiation. The tube 270/280 is  
2 preferably made of (silicone) rubber and/or plastic material or  
3 any other suitable non-metallic material. Certain material  
4 known to suppress or absorb electromagnetic radiation may also  
5 be used, as either the base material or an additive.

6

7 As shown in Figure 8, the hands-free kit 200 may incorporate a  
8 pair of the acoustic tubes 270/280, in which case the ends 272  
9 of both tubes 270 are connected to the inner end 254 of the  
10 second cavity 250 for simultaneous communication with the  
11 cavity 250. The pair of earplugs 284 can be used in both the  
12 left and right ears of a user.

13

14 As shown in Figure 9, the earplug 284 may incorporate a semi-  
15 circular bracket 285 for hooking onto the user's ear.

16

17 It is intended that the hands-free kit 200 may be supplied to  
18 the market without the hands-free earphone 12, such that  
19 customers may use their own hands-free earphones of the same or  
20 similar construction having compatible dimensions. For this  
21 purpose, the two parts 220 and 230 of the box 210 should not be  
22 welded or glued together in the first place but instead should  
23 be openable to allow insertion of a suitable hands-free  
24 earphone.

25

26 The invention has been given by way of example only, and  
27 various other modifications of and/or alterations to the  
28 described embodiments may be made by persons skilled in the art

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- 1 without departing from the scope of the invention as specified
- 2 in the appended claims.

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